## Avante Health Solutions



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Preventive maintenance is an integral part of maintaining the diagnostic confidence and safety of your ultrasound systems. Establishing a regular preventive maintenance schedule will increase the lifespan of your equipment and ensure the safety of your patients and operators.

We recommend that preventive maintenance be completed every six months throughout the life-cycle of the equipment. The frequency will help to establish a baseline for comparison of any anomalies and identify potential problems. Early identification of problems can result in less downtime as well as reduction of cost to maintain the equipment.

- > Introduction
- > Visual inspection
- > System diagnositcs
- > System cleaning
- > System disassembly

- > System reassembly
- > Diagnostic imaging
- > Pass/Fail criteria
- > Leakage testing

## Introduction



- > When possible introduce yourself to the user.
- > Inquire as to the current functionality of the equipment.
- > Inquire as to the current Network configuration.
- Ask if there are any items that need to be addressed during the PM:
  - > Software updates
- > Peripherals
- Options
- > Backups

## **Visual Inspection**

### MONITOR

- Inspect the monitor for obvious signs of damage and wear
- Inspect the monitor arm/mechanism; insure that it can support the monitor in a fixed location. Make sure the arm/mechanism can be secured via locking mechanism
- Inspect the screen for missing pixels, burn-in
- · Verify operation of brightness/contrast controls
- · Verify focus of the monitor

### **COSMETIC PANELS**

- Inspect all cosmetic panels/covers for obvious damage wear
- Closely inspect all panels for missing screws

### AC PLUG/CORD

 Inspect the electrical cord/plug for obvious damage/wear



#### **CONTROL PANEL**

- Inspect the entire control panel for obvious signs of damage/wear
- Closely inspect all keys, buttons, knobs, LEDs for and slide pots for functionality and missing cosmetic pieces
- Inspect touch screens/LEDs for missing pixels, focus and proper touch calibration
- Inspect trackball for proper operation (up, down, left, right)
- Inspect QWERTY keyboard for function of all keys
- Inspect down-lighting assembly for proper illumination
- Inspect control panel arm/mechanism

#### **CASTERS/BRAKES**

- · Inspect all casters for obvious damage/wear
- Inspect each caster for proper operation
- Inspect brake assembly for proper operation
- Make sure brake assembly can securely hold the system in place

## Transducers

### **PROBE CONNECTOR:**

- Bent, Broken, or Missing Pins
- Missing Housing Screws
- · Gaps in the Housing
- Broken/Missing Locking Knob



#### CABLE:

- Cut or Torn
- Stains
- · Separation of the cable and strain reliefs
- Exposed wires

#### **STRAIN RELIEF:**

- Separation between the probe and the cable
- Missing Strain Relief
- Cut or Torn

#### **PROBE HOUSING:**

- Gaps in the Seals
- Plastic Cracked or Broken
- Discoloration

#### **ACOUSTIC LENS:**

- Cuts / Chips
- Gaps in the Seals
- Discoloration
- Delamination

Any damage to the transducer that would allow fluid to infiltrate the transducers internal components is an AUTOMATIC FAILURE. The transducer should be removed immediately from service.

# **System Diagnostics**

- > Run diagnostics before performing any maintenance or disassembly
- > Diagnostics reside in setup/utility menus
- > Perform on-board user level diagnostics to verify system hardware and software
- > Note any and all failures



## **System Cleaning**

Use a gentle cleaning agent (SonoWipes or warm water & mild soap) and wipe down all surfaces of the equipment to include:

- > Monitor/LCDs
- > Handles
- > Transducers

- > Control Panel
- Cosmetic Panels



# **System Disassembly**

- > Shut down equipment and unplug
- > Remove all filters and clean; clean with a vacuum or warm water
- > Remove cosmetic panels
- > Remove card cage shields
- > Remove circuit boards from card cage (use ESD safe mat or bags)
- > Use ESD safe vacuum to clean the card cage and assemblies



## **System Reassembly**

- > Reinstall all circuit boards in to the card cage
- > Replace the card cage shields
- > Replace cosmetic panels
- > Reinstall all air filters once cleaning is complete







- > Power up the system and note any boot-up failures
- > Select New Patient & Enter "Test" Patient Demographics
- > Select a transducer
- > Select a factory default preset according to probe type
- > Acquire/Save an image in each mode of operation

### **2D MODE**

(Use 2D Gain Control and TGC Controls)

- > Acquire an even gray-scale image both vertically and horizontally
- > Look for signs of weak or dead elements within the scan field
- Once the image is acquired, select a set of targets to perform measurements with and freeze the image
- Select calipers and measure both horizontal and vertical targets. (Horizontal Expected Distance =2.00cm, Vertical Expected Distance =1.00cm)

### **IMAGE UNIFORMITY CHECKS**

- > Average brightness at the edge of the scan field is the same as in the middle
- > No signs of shadowing vertically or horizontally in the scan field
- > No brightness transitions between focal zones



**NOTE:** Use Imaging Phantom and Human Anatomy



### **M-MODE**

(Use 2D/M-MODE Gain Control and TGCs)

- > Acquire an even gray-scale image both vertically and horizontally (Image Uniformity Checks)
- > Select a target on the phantom within the scan field
- > Engage the M-MODE sample line and adjust to the selected target
- > Ensure the scrolling graphics display is working properly



## **COLOR DOPPLER**

(Use 2D Gain, Doppler Gain and TGCs)

- > Acquire an even gray-scale image both vertically and horizontally (Image Uniformity Checks)
- > Acquire an anatomical image based on the transducer and preset selected
- > Engage the Color Doppler function
- > Adjust the ROI (Region of Interest) using the trackball
- > Select an area with measurable blood-flow
- > Adjust the Color Doppler Gain, Doppler Scale and Baseline to show proper blood-flow in the selected area



## **SPECTRAL DOPPLER**

#### (Pulsed & Continuous Wave)

- > Acquire an even gray-scale image both vertically and horizontally (Image Uniformity Checks)
- > Acquire an anatomical image based on the transducer and preset selected
- > Engage PW or CW function (CW is only available for Cardiac functions)
- > Select an area with measurable blood-flow
- > Adjust the Gate or Sample Line using the trackball
- Adjust the Doppler Gain, Doppler Scale and baseline to display the correct spectral waveform for the area of interest



## 3D/4D

- > Acquire an even gray-scale image both vertically and horizontally (Image Uniformity Checks)
- > Acquire an anatomical image based on the transducer and preset selected
- > Engage the 3D function
- > Adjust the ROI (Region of Interest) using the trackball
- > Freeze the image or engage 3D/4D rendering



### **MEDIA**

- > Select the "Test" patient from the Patient Archive/Hard Drive
- > Designate Storage Location: CD/DVD/USB
- > Send patient file to specified storage location
- > Verify successful write to removable media



## **DICOM NETWORKING**

- > Select the "Test" patient from the Patient Archive/Hard Drive
- > Designate DICOM Server destination
- > Send "Test" patient file to DICOM Server
- > Verify successful transmission either by successful send message on the machine or physical verification on the server



# **Pass/Fail Criteria**

### TRANSDUCERS

#### > Image

- > 2 or more dead elements within the scan field
- > 4 or more weak elements within the scan field
- > Excessive Color Noise (Noise present at minimal gain)
- > Excessive PW/CW Doppler Noise (Noise present at minimal gain)
- > Inability to perform 3D/4D scan

#### > Cosmetic

> Any damage that would allow liquid to infiltrate the transducer's internal components.



## **TRANSDUCERS**

#### TEE Transducer (Type CF) MUST BE PERFORMED BEFORE EACH USE

- > 0.01mA (10 microamperes) under Normal Conditions
- > 0.05mA (50 microamperes) under Single Fault Conditions

#### GENERAL Transducer (Type BF)

- > 0.1mA (100 microamperes) under Normal Conditions
- > 0.5mA (500 microamperes) under Single Fault Conditions

## **TEE TESTING PROCEDURE**

We recommend the BC Biomedical Group ULT-2020 Ultrasound Transducer Leakage Tester. The ULT-2020 is simple to use, with OEM specific adapters that ensure the transducer is connected properly, one button bath test and transducer leakage test and the ability to print reports directly from the device. Easy to read pass/fail test message eliminating confusion about leakage limits.

- 1. Saline Bath should consist of 27g salt per 3 liters of water.
- 2. Once the ULT-2020 is powered up and passed it's power up self test, the unit is ready for testing.
- 3. Connect the dual connectivity probe to the Chassis port of the ULT-2020 and attach it to the test basin.
- 4. Press the Select Button and use the Up & Down buttons to select the OEM, then use the Up & Down buttons to select the transducer model.
- 5. Connect the OEM probe adapter to the External port of the ULT-2020 and plug in the transducer for testing.
- 6. Press the Bath Test button. If the Bath test passes, proceed to the next step. If the Bath test fails, discontinue the test.
- 7. Insert the probe into the test basin, at least 50cm.
- 8. Press the Full Test button. If the Full test passes, proceed to the next step. If the Full Test fails, the transducer should be retested and removed from service after a second failure.
- 9. Remove the transducer from the basin and wipe off any excess water.
- 10. Record or Print the test results for record keeping.









- Centers for Medicare & Medicaid Services; Center for Clinical Standards and Quality & Certification Group. Ref: S&C: 14-07-Hospital http://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertification-GenInfo/Downloads/Survey-and-Cert-Letter-14-07.pdf
- 2. American College of Radiology: Ultrasound Accreditation Program Requirements: Quality Control; Preventative Maintenance http://www.acr.org/~/media/ACR/Documents/Accreditation/US/Requirements.pdf



